

Question 1

Compute the indefinite integral

$$\int x^2 e^x dx.$$

Question 1 - Solution

Use integration by parts with

$$u = x^2, \quad dv = e^x dx.$$

Then

$$du = 2x dx, \quad v = e^x.$$

So

$$\int x^2 e^x dx = x^2 e^x - \int 2x e^x dx.$$

Apply integration by parts again to $\int 2x e^x dx$:

$$u = 2x, \quad dv = e^x dx \Rightarrow du = 2 dx, \quad v = e^x.$$

Thus,

$$\int 2x e^x dx = 2x e^x - 2 \int e^x dx = 2x e^x - 2e^x.$$

Hence,

$$\int x^2 e^x dx = e^x(x^2 - 2x + 2) + C.$$

Final Answer:

$$\int x^2 e^x dx = e^x(x^2 - 2x + 2) + C$$